

# Math 115

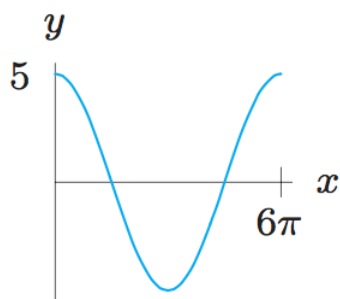
## Worksheet Section 1.5

**Important remark:** In this worksheet, all the angles under consideration are in *radians*.

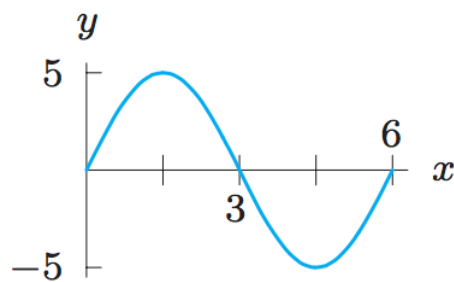
**Problem 1.** Answer the following questions in terms of  $A, B, C$ . If you are stuck, try first with  $C = 0, A = 1, B = 1$ .

- (a) The sinusoidal function  $f(t) = C + A \sin(Bt)$  has amplitude \_\_\_\_\_ and period \_\_\_\_\_.
- (b) The sinusoidal function  $g(t) = C + A \cos(Bt)$  has amplitude \_\_\_\_\_ and period \_\_\_\_\_.
- (c) How would I triple the amplitude of  $\sin(x)$ ? Double the period of  $\cos(x)$ ?
- (d)  $C + A \cos(0) =$  \_\_\_\_\_ and  $C + A \sin(0) =$  \_\_\_\_\_.

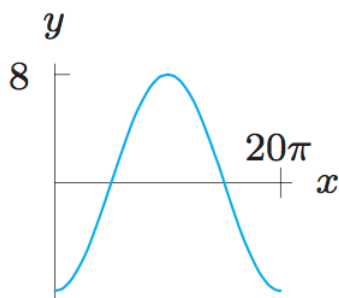
**Problem 2.** Find a possible formula for each of the graphs below.



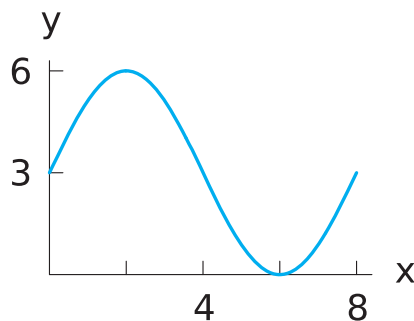
(a)



(b)

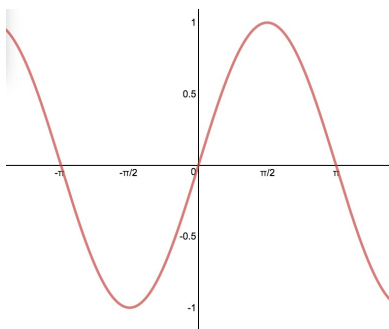
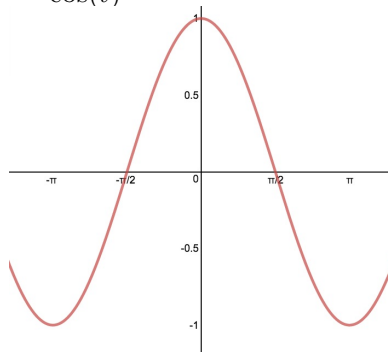
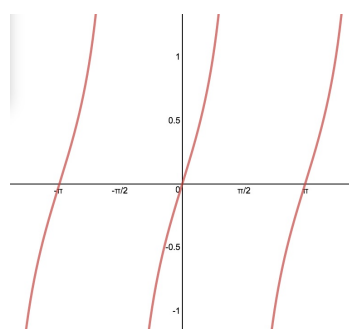


(c)



(d)

**Problem 3.** The desert temperature,  $H$ , oscillates daily between  $40^\circ\text{F}$  at 5am and  $80^\circ\text{F}$  at 5pm. Write a possible formula for  $H$  in terms of  $t$ , measured in hours from midnight. Draw a graph of  $H(t)$ . What are the period and amplitude of  $P(t)$ ?

**Problem 4.**  $\sin(t)$  $\cos(t)$  $\tan(t) = \frac{\sin(t)}{\cos(t)}$ 

- (a) How many solutions can you find on the graph above to  $\sin(t) = 0.5$ ?
- (b) Estimate them (roughly – you can use that  $\pi \approx 3$  if you like).
- (c) How are these solutions related to each other, and how would you find more solutions?
- (d) Which of these solutions gets the special name “ $\arcsin(0.5)$ ?”
- (e) Repeat parts (a)–(d) for both  $\cos(t) = 0.5$  and  $\tan(t) = 0.5$
- (f) (1.5 #27, 31) Find a solution for each of the following equations, if possible:

$$2 = 5 \sin(3x)$$

$$8 = 4 \sin(5x)$$

**Problem 5.** (Winter 2012 Exam 1 Problem 7) Enjoying breakfast outdoors in a coastal Mediterranean town, Tommy notices a ship that is anchored offshore. The ship is stationed above a reef which lies below the surface of the water, and a series of waves causes its height to oscillate sinusoidally with a period of 6 seconds. When Tommy begins observing, the hull of the ship is at its highest point, 20 feet above the reef. After 1.5 seconds, the hull is 11 feet above the reef.

- (a) Write a function  $h(t)$  that gives the height of the ship’s hull above the reef  $t$  seconds after Tommy begins observing.
- (b) According to your function, will the hull of the ship hit the reef? Explain.